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The Study of the Parameterization of the Drum Brake Design Based on UG

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Abstract

This text apply UG software to the design and study on the type parameter of the brakes. On the basis of the principles of discretization, discretize the structural pattern of the brake drum. select the typical characteristic of the brake assemblies and the individual parts of the 3d parameterization modeling work, to build a model for parameterization library calls.

Keywords: the brakes; ug; parameterization; discretization; research

The brake is the key components of the car industry. with the rapid development and people living standards improve in the design of the brake the car raised a more stringent requirements. not only to satisfy the brake the basic properties are required, to satisfy the stringent requirements of the environmental protection. this article mainly study on the brake drum the parameterization design.

1.The Brake Discretization

With the parameter change, the change situation which in the template characteristic possibly appears: a) the characteristic maintenance is invariable, is only the size reproduce by pantograph; b) the structure characteristic changes.

Above two kind of change situation, in actual operation, because selects the template with the simulated target size difference which must design is not very big, therefore mainly has the first kind of situation, the size changes in the characteristic maintenance scope. when the parameter change quite is fierce , is the second kind of situation, this request establishment template must describe the model comprehensively. Certainly, if a template closer model, the characteristic which must increase manually are less, but this template has representative and typical nature bad somewhat; The template with awaits construction the model to have certain disparity, needs to increase manually the characteristic are many, but its representation and typical nature are good somewhat. This is a pair of contradictory, in the construct

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of the template should find a quite good balance point, like this can both establish the representative template, and speeds up the spare part the design speed.

Then according to certain separate rule, is separated each model brake the corresponding spare part, withdraws the typical characteristic from these spare parts, forms the template that the parameterization design request.

The deference separate rule is:

1.1.Approximate components extraction same characteristic.

1.2.Peculiar part alone carries on the characteristic extraction.

1.3.Carries on the characteristic extraction, should withdraw the similar characteristic as far as possible.

1.4.Characteristic extraction, considers its realization the possibility.

After the drum brake discretization, components is as follows:

- Friction disk (about two pieces);
- Bbrake shoe (type);
- Sells on consignment；
- The cylinder body (type)；
- Piston (type);
- Leather cup (type);
- Brake drum (type);
- Brake shield plate (type);
- Fluctuates the supporting pole (type);
- Spring (type);
- The appendix (bushing dirt-proof boot, piston dirt-proof boot, deflates bolt nut, oil inlet safety mask, seal packing collar, bolt guards against loose rubber band, separates master cylinder to leave oil tight sealing ring and each kind of spring and so on)

After above lists only is the discretization the components unification name, regarding under a specific name, there are many kind of characteristic different components, this request separately establishes the template, to satisfy the demand about the design, for instance under the cylinder body name, has at least 5 kind of different type cylinder bodies, therefore must establish the template separately. Although extracted certain cycle of songs's brake to take the template, but has also established many special characteristic components template, therefore said from essentially, it's based on each components discretization.After the choice discretization template components, and defer to the request the size to produce the new components model, again assembles the brake system.

When each components is parameterized, the parameter integer must control strictly, must use as far as possible few parameters to describe the entire components. Size which certainly here parameter refers to the size which is may change, the components majority of sizes needs to use which these to be possible to change the size actuation (i.e. changes is independent variable, writes is actuated size function form), also is causes the multitudinous sizes to be connected, causes the overall linkage, completes the parameterization modeling work.

2.Brake Parameterization

This design uses the method based on the characteristic parameterization modeling, realizes the automobile brake spare part fast design and the automatic design. Therefore needs to make clear following several with the characteristic correlation concept.

2.1.Characteristic definition

Characteristic is high level abstract description that the designer describe the design object the function, the shape, the structure, the manufacture, the assembly, the examination, the management and the use information and the relations which has the accurate project meaning and so on. The characteristic model use logic in the interdependence, mutually carries on the description and the expression for the influence semantic network to the characteristic instance and the relations. compare with the low level geometry element surface, side, expressed the geometry entity method the difference is: The characteristic model expresses the high level to have the function significance entity, like the hole, the trough and so on, its operation object is not the primitive geometry element, but is the product function essential factor, the product technical information and the management information, manifests designer's intention.

2.2.Characteristic classification

Characteristic is the product description information set. The different application domain and the different object, the characteristic abstract and the classified method is different. Through analyzing mechanical product massive components blueprint information and the processing craft information, may constitute the components characteristic to divide into five big kinds:

- Management characteristic: With the components management related communications ensemble, including the title block information (for example components name, chart or illustration number, designer, design date and so on), the components material, has not poured information such as roughness and so on.
- Technical characteristic: Description components performance and specification communications ensemble.
- Material heat treatment characteristic: associated with components material and heat treatment communications ensemble, like material performance, heat treatment way, degree of hardness value and so on.
- Precision characteristic: Description components shape, size permission amount of variation communications ensemble, including common difference (size common difference and shape position common difference) and surface roughness.
- Shape characteristic: The communications ensemble which are related to description components shape, size, including function shape, processing craft shape, assembly auxiliary shape.
- Assembles characteristic: Components correlation direction, mutual active surface and coordinate relations.

In the characteristic above, the shape characteristic is most important characteristic that describes the components or the product. Its separable primarily characteristic and the auxiliary characteristic, the former is used to describe the structure object basic geometry shape, the latter is the characteristic which carries on the expression to the object partial shape

2.3.Characteristic relation

In order to describe the relation among characteristic, may apply the concept of characteristic class, the characteristic example. The characteristic class is the description about the characteristic type, is summary of all same information characteristic. The characteristic example is specific characteristic after the

characteristic attribute evaluation, is the member of characteristic class. Among the characteristic class, the characteristic example, the characteristic class and the characteristic example has relation as follows:

- Inherits relates \.Constituted level relation among the characteristic, which is located the level higher authority to be called the ultra kind of characteristic, is located the level lower level to be called the subgroup characteristic. The subgroup characteristic may inherit the ultra kind of characteristic the attribute and the method, this kind of inheritance relation is called the relation. Another kind of inheritance relation is the relation between characteristic class and this kind of characteristic example, this kind of relation is called the relation. For example, some concrete circular cylinder is a example that circular cylinder characteristic class, among themselves has reflected the relation.
- Adjacent relation. Reflected the mutual position relations among the shape characteristic, indicated with CONT. Among the constitution adjacency relation shape characteristic adjacency condition may share.For example, a steps and ladders axis, between each neighboring two axis section's relations are the syntopy, in which each adjacency surface condition may share.
- Hypotaxis.the description about shape characteristic compliance or the attached relations, indicated with IST. The subordinate shape characteristic relies on in the shape characteristic which is subordinated is existed, like bevel edge attached in circular cylinder.
- Quote relation. describing characteristic class as the connection attribute which the quotes mutually, indicated with RE. The quotation relation mainly exists in the quotation that the shape characteristic to the precision characteristic, the material characteristic.

2.4.Characteristic modeling

The method that describing product by characteristic as the modeling fundamental element is called modeling technology based on the characteristic. The characteristic modeling may induce approximately into three kind of patterns that the interactive characteristic definition, the trick recognition and the design based on the characteristic.

- Interactive characteristic definition. Using the existing geometry modeling system establishment product geometry model, the user, definition characteristic geometry essential factor in the graph interactive plan process, and add the information for example characteristic parameter or precision, specification, material heat treatment and so on to geometry model as the attribute. This kind of modeling method's automaticity is low, product data sharing is also difficulty realized, in the information processing process it is easy to arise the artificial mistake.".
- Characteristic recognition. the characteristic which defines in advance is carried on the comparison geometry model, definite characteristic concrete type and additional information. Usually it is composed by the following steps:①Searching product geometry database, match characteristic topo geometry model;②Withdraws the characteristic information from the database which oneself distinguishes;③Definite characteristic parameter;④Completes characteristic geometry model;⑤ Combines the simple characteristic to become the new characteristic.
- The design based on characteristic. The user directly defines components geometry entity with the characteristic, after soon in characteristic storehouse pre-definition characteristic instantiation, take example characteristic as basic unit establishment characteristic model, thus completes the product the definition or the design.

2.5.Parameterization design

Parameterization design is defines the geometric figure size value and agrees the size relations with group of parameters, provides to the designer to carry on the geometry modeling use. The parameter's solution is simple, the parameter and the design object control size has the explicit corresponding relations, the design result revision receives the size actuation. In the production commonly used the product which

monlding in the design object structure shape, the serialized standard letter belongs to this type. Parameterization design system principle as shown in Figure 1.

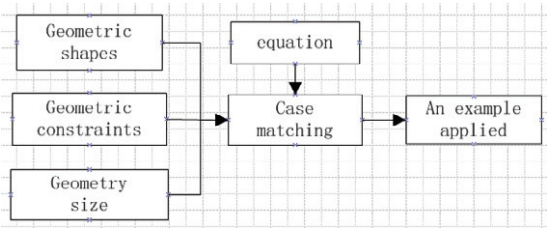

Fig.1 Principle of parameterized design system

2.6.Parameter design

In the process of the parameter design, search the restraint relations from the CAD graphic file, then turn the graph fixed size into the parameterization graph automatic, the new development parameter cartography software algorithm will be supposed to be advantageous to the old chart parameterization reconstruction. At present, this is the most methods in the parameterization design applies. Regarding serialized, universalized and the standardized stereotypia product (for example mold, jig, hydraulic cylinder, aggregate machine-tool, valve and so on) 's design the mathematical model and the product structure which uses all are relatively fixed invariable, only the product mix size have a difference, the difference of the structure size is caused by the same number and the type datum takes the discrete value in the different specification product design. This kind of product may replace the basic parameter which changes along with the product specification with the corresponding variable, then according to these data and the basic parameter, use the computer automatic inquiry graph database, designs the graph automatically by the special cartography software on the screen. As shown in Figure 2 for the parameterization design process.

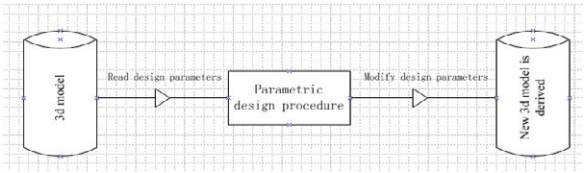

Fig.2 The course of 3-Dmodel Parameterized design

3.The Three Dimensional Entity Parameterization Design

Parameterization modeling 's main thought is to show the product model the shape characteristic with the geometry restraint, mathematics equation and the relations, thus the designs has the similar in the shape and the function. The parameterization entity modeling 's key is the geometry restraint relations extraction and expression, the solution as well as the parameterization geometry model structure. Many kinds of geometry restraint relations, may write one kind of specific form document including the simultaneous equation group (i.e. user programming), inputs the computer, actuates geometry design in groups. For

example, determined a cube 's constraint condition L, W, H may form using the cube the floor space and the bottom surface perimeter, face the expression way of artificial intelligence knowledge, this way will describe the restraint relations of the geometry physique, the geometry and topology with a step logic predicate form, and will read in the knowledge library. On the one hand the knowledge expression way is changes into the form by the mark to express each kind of type the data, seeking mark solution; On the other hand is adds on geometry inference based on restraint, seeking numerical solution, thus realizes the mechanical product intelligent design in a greater degree. The 3D parameterization model is two major part is composed by the geometry model and the restraint information. According to on what size restraint and the order of the topo information model structure, that is the interdependence relations between them, the parameterization modeling may divide into two kinds successively. One kind is the geometry restraint acting on the fixed topology physique geometry tissue, geometry restraint value does not change the geometry model topology, but changes the nominal size of the geometry model.

This kind of parameterization modeling system take B-rep as its internal expression principal-mode. Another kind is explains the parameterization model the geometry integrant part first and the restraint relations between them, but model topology is decided by the restraint relations. This kind of parameter modeling system take CSG expression as internal principal-mode, may change the full-scale mockup topology, and is advantageous recording structure entire process by the procedural form.

4.The Drum Brake Model Establishment Example

Through to structure analysis of the drum brake separate components, the components modeling may use three modeling methods.

4.1.Uses the plate work modeling of parts

Plate work modeling and the parameterization process is similar to the entity modeling, through the two-dimensional schematic diagram plan components correlation characteristic, joins the restraint, and labels the related size. Using the operation of plate work module in curved side, the pit, the ramming eliminates and so on producing three-dimensional entity model. And associate main parameter with secondary parameter through expression . Like Figure 3 is the brake shoe sheet metal model.

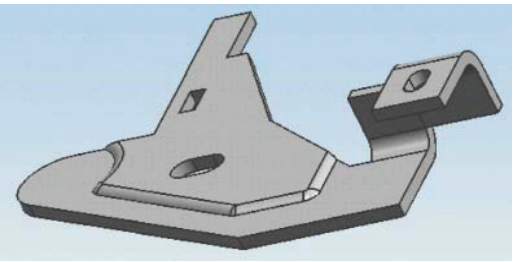

Fig.3 The3-D model Parameterized design of sheet metal

4.2.What about rotascope for example the spring use the rule curve function edition modeling

Take the spring as an example, first analyzes the spring structure in each spot, and express the main parameter for example hypothesis spring outer annulus diameter with the fundamental function, the internal bore diameter, the turn and so on, then edits rule function of the spring in the rule curve in X, Y, the Z axis direction on the basis of the main parameter for example $X1 = radius - r1 - \cos(dir * 180 * t) * rl$ $Y1 = r$ $Z1 = r1 * \sin(dir * 180 * t) + height + wire\_{}^{dia}\!/_{2} + r + l$ Moves

these rule curve function, may produce the spring's central path curve, again through sweeps plunders produce the spring full-scale mockup, as shown in Figure 4.

4.3.May use the compound method modelling regarding the structure complex components

Regarding the complex shape components often not to be able to realize using several modelling method any kind above, by now we might use the method above, use several methods to establish the geometry model we need.As shown in Figure 5 the brake chassis is uses compound method which the entity modeling and the sheet metal modeling unifies to complete.

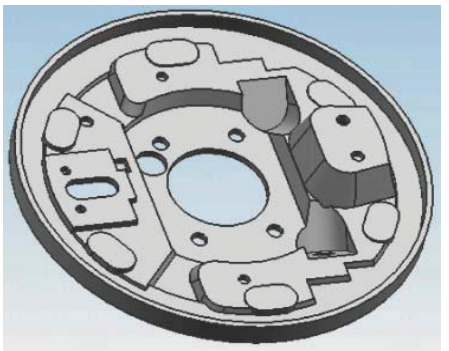

Fig.5 The3-D model Parameterized design of chassis

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